EEE 313 - Electronic Circuit Design - Lab 2 Preliminary Report
Tuna Şahin - Low Voltage Dropout Regulator

Introduction:

For this lab we were asked to implement a low voltage dropout regulator. For this, we used a zener diode to have a stable voltage reference, and used OPAMPS for feedback and regulation.

Calculations:

My BilkentID is 22201730 therefore I chose my V_{cc} to be 9.5V.

$R_1 = (V_{out} - V_Z)/0.003 \Rightarrow 1466\Omega$

$\frac{R_2}{R_2+R_3} = \frac{V_Z}{V_{out}} \Rightarrow R_2 = 100k\Omega, \quad R_3 = 116k\Omega$

$R_6 = R_2 \parallel R_3 \Rightarrow 53.6\Omega$

by measuring the ß of the BJT as 100 we can calculate R_5 as:

$R_5 = ß_{min}(V_{out} - 1)/I_{max} \Rightarrow 8500\Omega$

$R_4 = 0.8R_5 \Rightarrow R_4 = 6800\Omega$

$\frac{R_2}{R_2+R_3} = \frac{V_{o2}}{V_Z} \Rightarrow R_7 = 500k\Omega, \quad R_8 = 10k\Omega$

$R_9 = R_7 \parallel R_8 \Rightarrow 9800\Omega$

$R_{10} = (V_{in} - 2)/0.005 \Rightarrow R_{10} = 1500$

Component List:

- 2 x 10µF electrolytic capacitors.
- 1 x 70pF capacitor.
- 1 x 3.3Ω resistor.
- 1 x 6.8kΩ resistor.
- 2 x 1.5kΩ resistor.
- 2 x 1MΩ resistor.
- 1 x 1.2MΩ resistor.
- 1 x 100Ω resistor.
- 1 x 1.8kΩ resistor.
- 1 x 68kΩ resistor.
- 3 x 10kΩ resistor.
- 2 x 56kΩ resistor.
- 1 x 150kΩ resistor.
- 1 x 560kΩ resistor.
- 1 x 100Ω resistor.
- 1 x UMZ5_1N diode
- 1 x LM358 Dual Opamp
- 1 x BD136 BJT
- 1 x LED
- 1 x 820Ω resistor.
- 1 x 100kΩ resistor.

LTSpice Simulations:

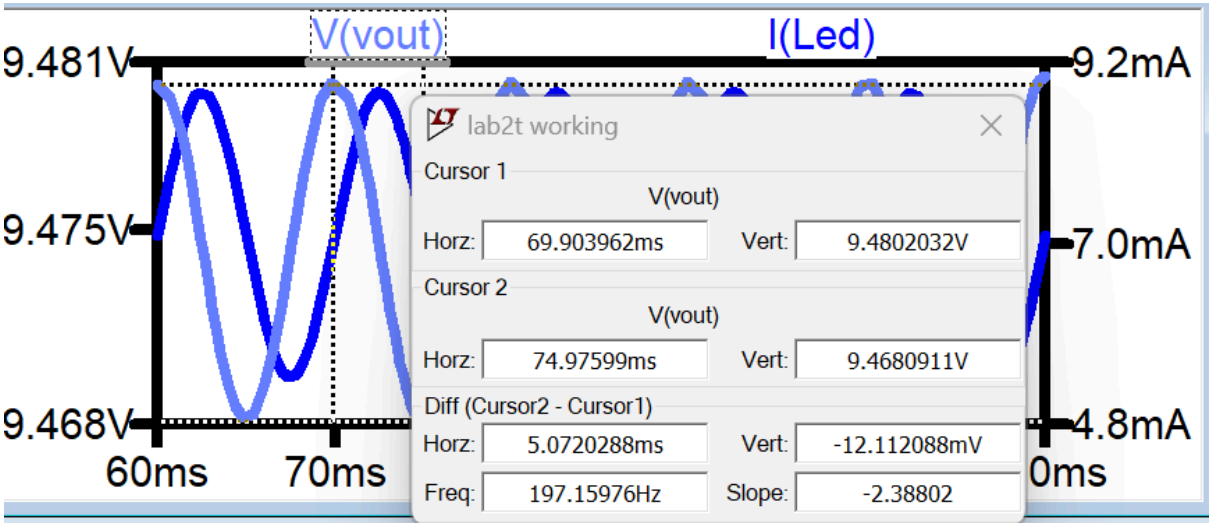

Figure 1.1: Line Regulation Output Voltage and corresponding LED current

Observation: 133 Hz was the maximum frequency that had a ripple voltage < 20mV.

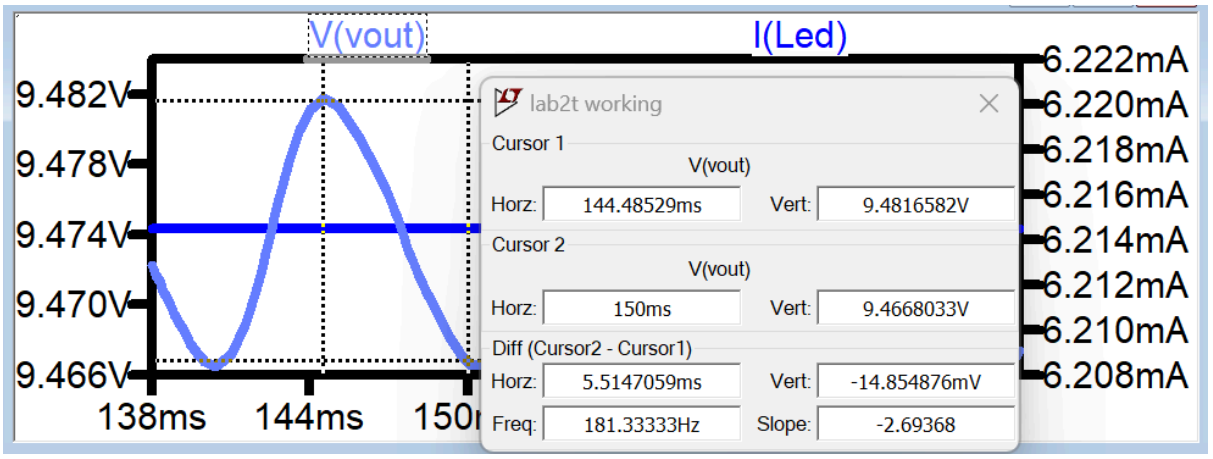

Figure 1.2: Load Regulation Output Voltage and corresponding LED current.

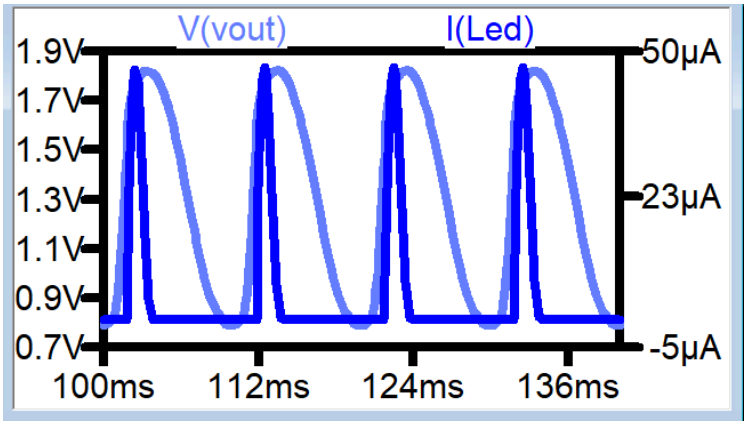

Figure 1.3: Low Voltage Line Regulation Voltages and LED currents

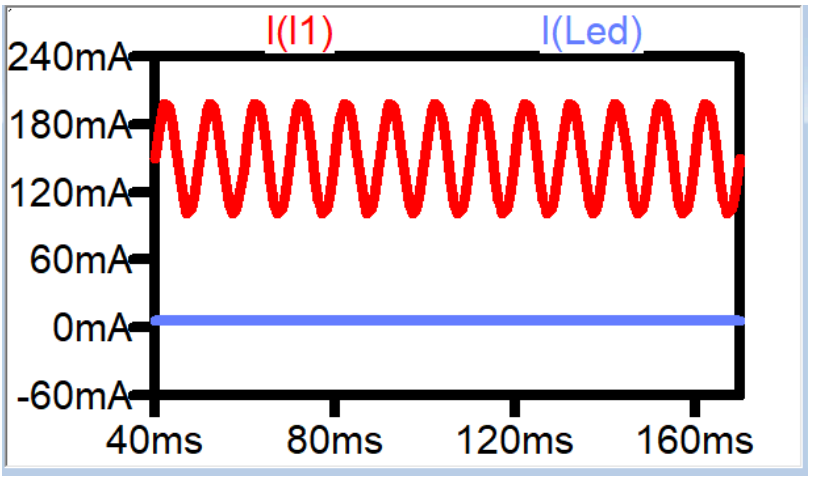

Figure 1.4: High current drawing load and LED currents.(LED off)

Transistor Properties:

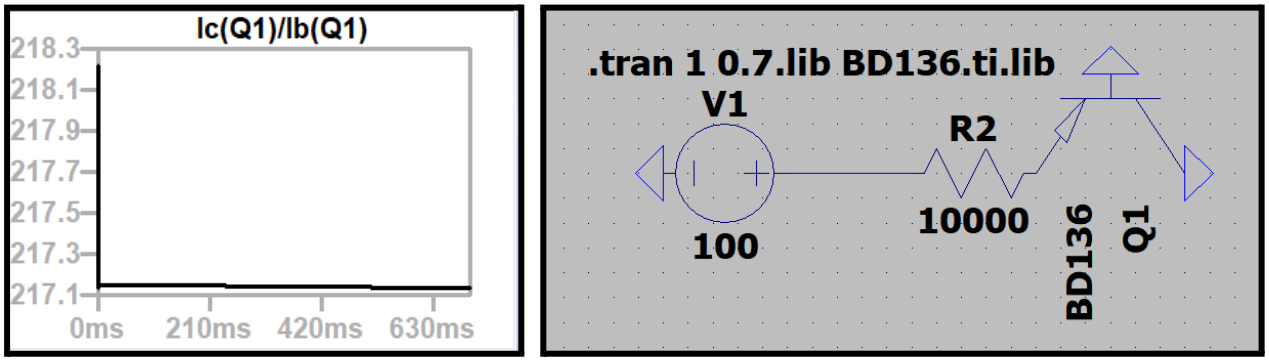

Figure 2.1: β measuring circuit.(Ratio of $I_C/I_B = \beta$)

$$r_{\theta ja} = 100K/W$$
$$r_{\theta jc} = 10K/W$$

And taking $P_D = 0.3W$ we get the following results:

$$T_j = 25 + 100 \,.\, 0.3 = 55$$
$$T_C = 55 - 10 \,.\, 0.3 = 52$$

Schematics:

#	Name	Manufacturer	Quantity
1	CAP		1
2	CAP100		1
3	CAP200		1
4	1N4100-1	Microsemi	1
5	LED		1
6	2SA1552T-TL-E	ON Semiconductor	1
7	RES400		2
8	RES		13
9	RES850		2
10	RES500		2
11	LM358AD	ST Microelectronics	1

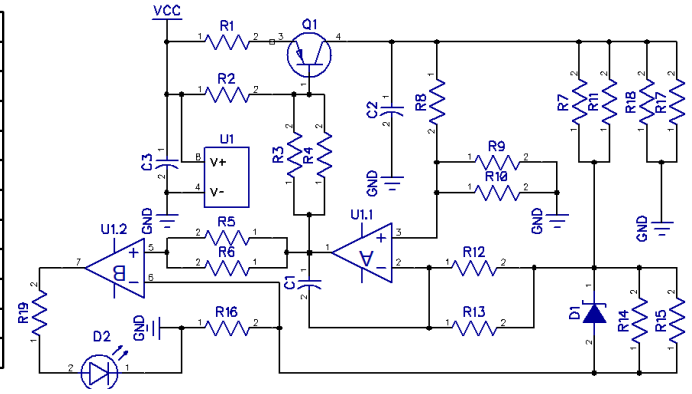

Figure 3.1: DipTrace Schematic

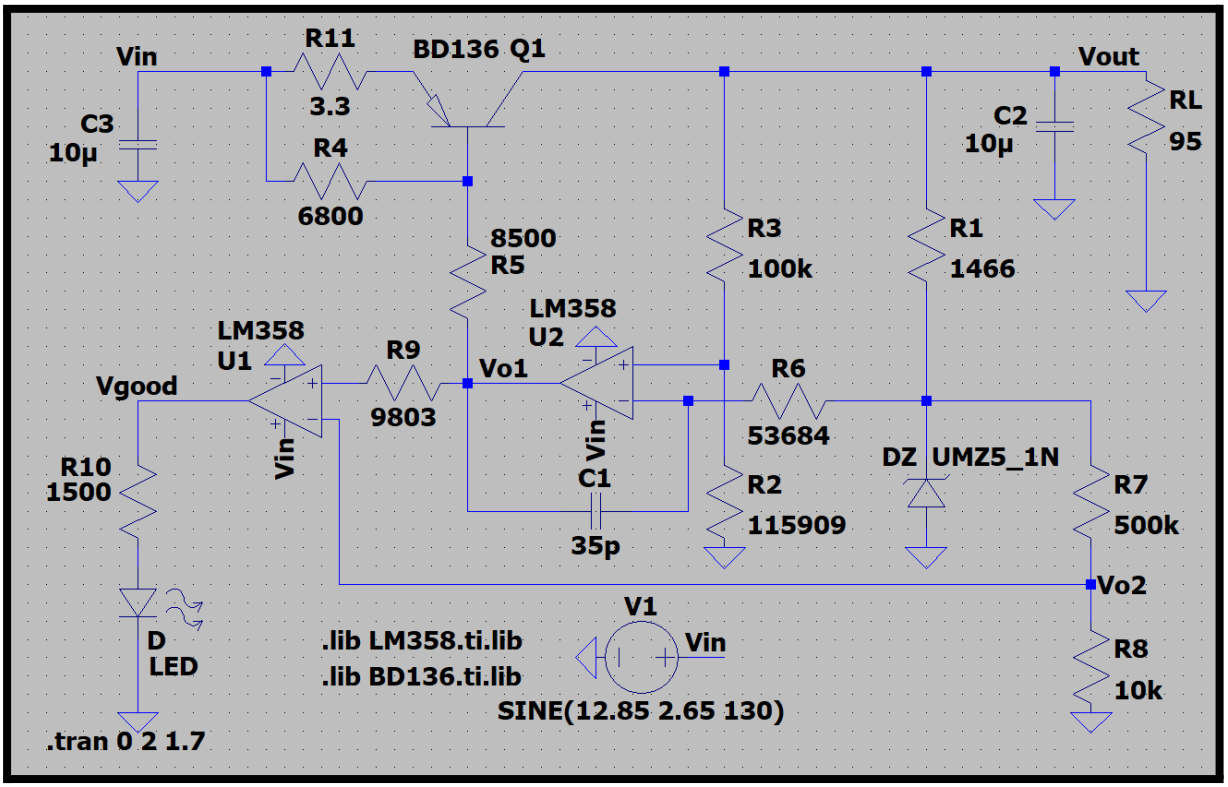

Figure 3.2: LTSpice Schematic